

SE13-Q426-RJ Specifications
Sanitary Sewer Connection Marble Hill Maintenance Facility

GENERAL

The bidder shall provide all labor, equipment and material necessary to furnish, install, test and place in operation a pre-fabricated Package Lift Station as shown in the plans and as specified herein as required for a complete operating system.

The design shall be such that the pumping unit will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pump shall be easily removable for inspection or service without the need for removal of nuts, bolts or other fasteners and without the need for personnel to enter the wet-well. The pump shall be fitted with a stainless steel lifting chain of adequate strength and length to permit raising the pump for inspection and removal.

The bidder shall also provide all labor, equipment and materials to properly connect Marble Hill Maintenance Facility and Truck Wash Bay to the above Package Lift Station as shown on plans.

QUALITY ASSURANCE

Qualifications of Manufacturers: The pre-fabricated lift station shown on plans is based on the products manufactured by Environmental One Corporation, Niskayuna, New York. Product numbers and references are given only as an indication of the quality of materials and workmanship to be used.

QUALITY CONTROL

The Submersible Pumping Unit shall conform to all applicable requirements of NEMA, IEEE, NEC, SWPA and Hydraulic Institute. For purposes of this specification, the revision and/or version of the referenced standards in effect on the date of public bid opening shall apply.

The Submersible Pumping Unit shall be the product of a reputable manufacturer who has been regularly engaged in the design, manufacture and furnishing of Waste Water Pumping Equipment for a minimum of ten (10) years. The manufacturer of the pump shall assume full responsibility for the compatibility of the supplied components with the application. The motor and pump shall be manufactured by one company providing sole source responsibility for the warranty of the unit. Manufacturers who do not manufacture the submersible motor and who limit their warranty to that of the motor manufacturer shall not be acceptable.

PUMPS

The Submersible Pumping Unit shall be capable of delivering 15 GPM against a rated total dynamic head of 0 feet (0 PSIG), 11 GPM against a rated total dynamic head of 92 feet (40 PSIG), and 7.8 GPM against a rated total dynamic head of 185 feet (80 PSIG). The pump must also be capable of operating at negative total dynamic head without overloading the motor.

The Submersible Pumping Unit shall be self-contained, integral pump/motor units designed to operate at continuous full load in a partially or completely submerged condition without the need for any external cooling devices such as water jackets. The air filled motor shall be cooled by an adequately sized motor frame, which shall conform to the latest applicable requirements of NEMA, IEEE, ANSI and NEC standards and shall meet the latest design standards of a Totally Enclosed Non-Ventilated NEMA frame motor. Heat transfer shall be accomplished by convection through the stator-housing wall to the surrounding media. Designs which incorporate cooling jackets and in particular, designs which rely on circulation of the pumped sewage or externally sourced water for cooling, are not considered equal to the equipment described in this specification and shall not be acceptable.

The nameplate ratings of the motor shall be based on 104° F ambient environment. The pump motors and all associated sealing devices shall be designed to operate submerged at a depth of 150 feet of water. All motors shall be furnished and certified per IEEE 117 with Class H rated insulation materials. All motors not having IEEE 117 certified insulation systems shall be considered not acceptable. Insulation materials rated lower than Class F (i.e. Class B or A) are specifically prohibited.

BEARINGS AND LUBRICATION

Bearings shall be specifically selected to carry all radial and axial loads imposed by the pump and motor.

Bearings shall be rated to provide a minimum L₁₀ Bearing Life of 25,000 hours at any design operating point within the allowable operating region (limit lines). Bearing selection shall limit the bearing temperature rise to a maximum of 140° F under full load operation.

All bearings shall be permanently lubricated with a premium moisture resistant grease containing rust inhibitors and shall be suitable for operation over a temperature range of -13° F to +248° F. The bearings shall not require any additional or periodic lubrication. All bearings shall be commercially available from third party sources other than the pump/motor manufacturer.

SHAFT SEALS

Two independent, tandem mounted, mechanical seals shall be provided in the oil filled housing to isolate and protect the air-filled motor from the pumped media. The oil level shall not require constant monitoring and shall be suitable for a minimum of two (2) years service under specified operating conditions before requiring replacement for normal maintenance. The oil reservoir shall act as a barrier to trap moisture and provide sufficient time for a planned shutdown in the event of an outer seal failure. The inner mechanical seal shall be constructed with a solid block carbon rotating seal face and a solid block silicon carbide stationary seal face. The outer mechanical seal shall be constructed with a solid block silicon carbide rotating seal face and a solid block silicon carbide stationary face. All other metal components of the inner and outer seals shall be AISI 316 stainless steel. All elastomers of both inner and outer seals shall be of Viton® material. The outer mechanical seal shall be located in a recessed housing outside the main flow path of the pump to avoid damage. Mechanical seals that employ sprayed or laminated seal faces shall neither be considered equal, nor shall they be acceptable.

Mechanical seals shall be readily and commercially available from third party sources other than the pump and motor manufacturer, their agents, dealers and/or distributors. Mechanical Seals shall be Type 21 or approved equivalent.

MOISTURE DETECTION SYSTEM

A dual (2) probe moisture sensing system shall detect the entrance of moisture and provide an alarm. The moisture detection system shall be designed to detect the entrance of moisture in the stator and lower oil seal housing. The use of single probe or float switch type sensor systems shall not be acceptable. The moisture sensing probe leads shall terminate at a conductance relay located in the control panel, which shall provide an alarm in the event of moisture intrusion. The sensing relay (if not specifically ordered from the pump manufacturer) shall be approved by the pump/motor manufacturer.

CABLE ENTRY SYSTEM

The power and control cable entry system shall be designed to provide a positive, leak-free seal to prevent liquid from entering the air filled motor housing. The design shall incorporate provisions that prevent moisture from wicking through the cable assembly even in the event the cable jacket has been punctured. All cable shall be type SEOW-A or better and U.L. Listed for the intended submersible service.

The power and control cable entry into the lead connection chamber shall be epoxy encapsulated for positive moisture sealing. For frame size 180 and above, the power and control cables shall be unitized modular assemblies permitting individual repair or replacement. Each modular cable unit shall include a cast iron connector body with flared inlet to protect against cable damage due to bending or flexing at the entry point. Each cable unit shall include both epoxy seal and a Buna-N sealing grommet. A sleeve/spacer shall be provided to isolate the epoxy from the connector body and facilitate easy removal and replacement of the sealing compound. Assembly of cable components and grommet tensioning shall be accomplished by a precision snap-ring connection to prevent cable damage or leakage due to under or over compression. The system shall permit the use of factory supplied epoxy or other commercial sealants for field repair without voiding the rating of explosion proof units. Cable strain relief shall be independent of the epoxy seal. Individual cable units shall be designed to permit repair or rebuilding independent of the motor.

Each cap & cable assembly shall include a modular design rail-mounted terminal block system with individual terminal units for connection of each power and control lead. The terminal block system shall utilize standard non-proprietary commercial components.

MATERIALS OF CONSTRUCTION - MOTOR

The submersible motor enclosure including frame, end brackets, flanges and cap assembly shall be constructed of close-grained cast iron, ASTM A-48, Class 30 or better.

The top end bracket shall be fitted with a lifting bail and shall be capable of supporting four (4) times the combined weight of the pump and motor.

All mating fits on the motor frame shall have rabbet joints with large overlap as well as o-ring seals to provide for a watertight seal. O-rings shall be Buna-N.

The one-piece motor/pump shaft shall be constructed of stainless steel and shall be precision machined to ensure proper tolerances at all contact points. The entire rotating assembly shall be designed with sufficient rigidity and balanced for a minimal shaft deflection at extreme pump operating conditions.

The motor rotor shall be of squirrel-cage design and constructed of die cast aluminum, fabricated copper or their respective alloys. The rotor shall have an interference fit to the shaft and the rotating assembly shall be dynamically balanced to ISO 1940, G.6.3. Balance weights, if required, shall be secured to the rotor resistance ring or rotor fins. Machine screws or nuts and bolts used to attach balance weights are specifically prohibited.

ELECTRICAL

The submersible motors shall successfully operate under power supply variations per NEMA MG1-14.30. Motors shall be NEMA Design B with torque and starting current in accordance with NEMA MG1-12.

The submersible motors shall be of an air-filled, high efficiency design and shall be rated for continuous full load operation. The motor construction shall be of explosion proof, TENV-TEXP design and capable of being certified for use in Class I, Division 1, Groups C & D hazardous locations by Factory Mutual Research Corp. (F.M.). Motors shall be capable of withstanding up to 15 starts per hour and shall have a minimum 1.15 Service Factor at 104° F ambient.

Stators shall be solid copper wound and shall be press fitted into the stator housing for true positive alignment and efficient heat transfer. The motor insulation system shall be Class F minimum, utilizing materials and insulation systems evaluated and certified with IEEE 117 classification tests. The entire wound stator assembly shall receive a minimum of two (2) coats of insulating varnish utilizing a dip and bake process.

Three (3) normally closed, automatic reset thermostats connected in series shall be embedded in adjoining phases of the stator windings. The thermostats shall be connected to safely shut down the motor upon opening.

MATERIALS OF CONSTRUCTION - PUMP

The pump casing, impeller, motor housing and stationary base elbow shall be manufactured of close-grained cast iron, ASTM A48, Class 30.

The pump casing shall be of the semi-concentric volute design, of one piece construction, having centerline discharge to minimize clogging or flow interference, and to provide the proper weight distribution for use with the Easy-Lift disconnect system.

The impeller shall be of a multi or single-vaned, fully shrouded enclosed design and shall have large passages to provide smooth flow transition and unimpeded passage of large spherical solids. All impellers shall be statically and dynamically balanced to ISO 1940, G.6.3. Solids passing capability of the impeller offered shall be clearly indicated on the manufacturer's performance curve.

The volute suction shall be fitted with a replaceable hard polyurethane, radial/axial clearance, corrosion and abrasion resistant wearing ring system a minimum of 3/8 inch thick, securely fastened and replaceable.

All external casting surfaces of the pump/motor coming into contact with the pumped liquid shall have a surface cleanliness equal to that of a SSPC-SP6 process prior to being factory protected by one (1) coat of an environmentally-safe machinery enamel coating with a high solids content.

All external hardware including nameplates on the pump/motor shall be 300 Series stainless steel.

PREFABRICATED FIBERGLASS BASIN ASSEMBLY

The pump basin shall be of the laminated fiberglass type constructed of commercial grade resin and glass fiber reinforcing material. The reinforcing material shall have a coupling agent that will provide a secure bond between the glass reinforcement and the resin. The laminate shall consist of an inner surface, an interior layer and an exterior layer of laminate body. The inner surface shall have a smooth finish and shall be free of cracks and crazing. A minimum 0.100-inch of the laminate next to the inner surface shall be reinforced with not less than 20 percent nor more than 30 percent by weight of non-continuous glass strands having fiber lengths from 0.5 to 2.0 inches. The exterior layer of body of laminate shall be of construction suitable for the service intended and shall contain sufficient glass by weight to provide the aggregate strength necessary to meet the tensile and flexural requirements. The exterior surface shall have no sharp projections and shall contain adequate resin to prevent exposure of the fibers.

The basin wall shall be designed to withstand collapse based on the assumption that saturated soil exerts hydrostatic pressure of 120 pounds per cubic foot. The basin wall laminate shall be constructed to withstand a minimum of two (2) times the actual imposed loading on any depth of basin.

The basin shall be reinforced with a fiberglass bottom plate extending beyond the basin diameter. The bottom plate shall serve as an anti-flotation ring and shall be suitable for mounting to a concrete pad. Mounting studs shall be provided on the interior floor surface for factory assembly and mounting of the pump guiderail base elbows.

The basin shall be supplied with a solid fiberglass cover or a hinged aluminum cover rated for a 300 pound load.

SLIDING GUIDE BRACKET & RAIL SYSTEM

The pump slide bracket shall be of heavy-duty construction and shall be of a molded instant set polymer material. The slide bracket shall be sparkless design and shall be corrosion, abrasion and chemically resistant.

The base discharge elbow shall meet the slide bracket by method of a three point, wedged engagement that is uniquely designed to match the volute flange to the stationary elbow to eliminate head losses. The discharge elbow shall be manufactured of close-grained cast iron, ASTM A48, Class 30, and shall be designed to carry the full weight of the pump, motor and discharge piping.

Guide rail mounting brackets and guiderails shall be manufactured of stainless steel and shall be factory installed in the basin system.

PIPING & VALVES

The prefabricated fiberglass basin system shall be furnished complete with discharge pipes, fittings, check valves and shut-off valves. Discharge pipes shall be manufactured of *PVC or Ductile Iron*. The check valves shall be CLOW/Kennedy/M&H Swing Check type, cast iron ANSI Class 125 flanged, full-port type with external lever and weight, and shall conform to AWWA C-508 standards. The shut-off valves shall be ¼ turn eccentric plug type, cast iron ANSI Class 125 flanged, with 100% port area, and shall conform to AWWA C-504 standards. Valves that are not of the 100% port area design are not acceptable for the intended service.

ELECTRICAL & CONTROL ACCESSORIES

The prefabricated fiberglass basin system shall be furnished with a NEMA 4X Junction Box and fittings for connection of the pump power/control and level control wiring. Suspension type tilt level control switches, stainless steel mounting bracket and a 2" electrical conduit fitting shall be included. All electrical and control accessories shall be shipped loose for field installation.

PUMP CONTROL PANEL

The package lift station shall be furnished with an automatic pump control system housed in a NEMA *4X fiberglass or 4X stainless steel* enclosure. The control system shall include the following primary features:

- Main disconnect
- Motor starter/protector for each pump
- Start/run capacitor(s) - *for single phase systems only*
- Top mounted flashing alarm light
- Audible alarm with silence switch
- Pump run indicator
- Microprocessor based pump controller, including automatic alternation, pump run LED's, float activation LED's, alarm code blinker, pump fail LED and control power LED. To provide float loss indication and to maintain control even with the loss of up to three floats.
- Hand-Off-Automatic selector switch for each pump
- 24VAC float circuit
- Pump seal failure alarm indication
- Motor thermal overload circuit
- Aux. Contact for high-level alarm
- Terminals for all field connections
- U.L. 508 Listing
- *Elapsed Time Meter for pump*
- *Lightning Suppressor*
- *Dead Front with interior swing door*
- *A receptacle for connection of a portable auxiliary power generator*

INSTALLATION

Installation procedures shall be as recommended by the manufacturer, Hydraulic Institute Standards, MDNR Design Guide per 10 CSR 10.8.120 (Missouri Code of State Regulations) and as required herein.

All grinder pump units will be delivered to the job site 100 percent completely assembled, including testing, ready for installation

The bidder shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding.

Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4" inlet grommet (4.50" OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.

Installation shall be accomplished so that 1" to 4" of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.

A 6" inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.

A concrete anti-flotation collar sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump or poured in place. Each grinder pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes.

If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If

it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured.

The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the bidder. An alarm device is required on every installation. It will be the responsibility of the bidder and MoDOT maintenance personnel to coordinate and determine the optimum location for the Alarm Panel.

The bidder shall mount the alarm device in a conspicuous location, as per national and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor type TC cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits. The grinder pump stations will be provided with enough useable, electrical supply cable to connect the station to the alarm panel. This cable shall be supplied with a factory installed EQD half to connect to the mating EQD half on the core.

TESTING

Each completed and assembled motor shall receive a routine factory test.

After installation, a Field Test shall be performed by the installing contractor on each completed Submersible Pump under the supervision of the manufacture's authorized representative. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor or excessive motor heating.

WARRANTY

The Pump Manufacturer shall Warrant to the Owner the Package Lift Station components against defects in material and workmanship for a period of 2 years from date of acceptance or 27 months from date of shipment, whichever is sooner. This warranty shall cover the cost of labor and materials, excluding removal and reinstallation costs, required to correct any warrantable defect, FOB, Manufacturer's authorized Warranty Service Center.